

Section I. (Amendments to the Claims)

1. (Currently Amended) A supercritical fluid (SCF)-based composition, comprising at least one co-solvent, at least one etchant species, and optionally at least one surfactant, wherein said at least one etchant comprises an alkyl phosphonium difluoride ((R)₄PHF₂), where R is selected from the group consisting of hydrogen, [[a]] C₁-C₄ alkyl group, phenyl, and fluorinated C₁-C₄ alkyl, and wherein said SCF-based composition is useful for etching sacrificial silicon-containing layers.
2. (Previously Presented) The composition of claim 1, comprising SCF, wherein the SCF comprises a species selected from the group consisting of carbon dioxide, oxygen, argon, krypton, xenon, and ammonia.
3. (Previously Presented) The composition of claim 2, wherein the SCF comprises carbon dioxide.
4. (Original) The composition of claim 1, wherein the co-solvent comprises at least one C₁-C₆ alcohol.
5. (Original) The composition of claim 1, wherein the co-solvent comprises methanol.
6. (Original) The composition of claim 1, wherein the co-solvent comprises isopropanol.
7. (Original) The composition of claim 1, wherein the sacrificial silicon-containing layer comprises a silicon-containing species selected from the group consisting of silicon oxide and silicon nitride.

8. (Currently Amended) The composition of claim 1 [[7]], wherein the at least one etchant species further comprises at least one bifluoride compound selected from the group consisting of ammonium bifluoride, and tetraalkylammonium bifluoride $((R)_4NHF_2)$, wherein R is selected from the group consisting of hydrogen, [[a]] C₁-C₄ alkyl group, phenyl, and fluorinated C₁-C₄ alkyl.

9. (Cancelled)

10. (Cancelled)

11. (Cancelled)

12. (Currently Amended) The composition of claim 1, comprising said surfactant, wherein the surfactant comprises at least one nonionic or anionic surfactant, or a combination thereof.

13. (Original) The composition of claim 12, wherein the nonionic surfactant is selected from the group consisting of fluoroalkyl surfactants, polyethylene glycols, polypropylene glycols, polyethylene ethers, polypropylene glycol ethers, carboxylic acid salts, dodecylbenzenesulfonic acid, dodecylbenzenesulfonic salts, polyacrylate polymers, dinonylphenyl polyoxyethylene, silicone polymers, modified silicone polymers, acetylenic diols, modified acetylenic diols, alkylammonium salts, modified alkylammonium salts, and combinations comprising at least one of the foregoing.

14. (Original) The composition of claim 12, wherein the nonionic surfactant comprises a modified acetylenic diol.

15. (Currently Amended) The composition of claim 2 [[1]], comprising said surfactant, wherein the SCF-based etching composition comprises about 75.0 wt % to about 99.5 wt % SCF, about 0.3 wt % to about 22.5 wt % co-solvent, about 0.01 wt % to about 5.0 wt % etchant species, and about 0.01 wt % to about 5.0 wt % surfactant, based on the total weight of the composition.

16. (Cancelled)

17. (Cancelled)

18. (Cancelled)

19. (Currently Amended) A method of removing silicon-containing substances from a substrate having same thereon, said method comprising contacting the substrate with a SCF-based composition comprising at least one co-solvent, at least one etchant species, and optionally at least one surfactant, for sufficient time and under sufficient contacting conditions to remove the silicon-containing substances from the substrate, wherein said at least one etchant comprises an alkyl phosphonium difluoride ((R)₄PHF₂), where R is selected from the group consisting of hydrogen, [[a]] C₁-C₄ alkyl group, phenyl, and fluorinated C₁-C₄ alkyl.

20. (Previously Presented) The method of claim 19, comprising SCF, wherein the SCF is selected from the group consisting of carbon dioxide, oxygen, argon, krypton, xenon, and ammonia.

21. (Previously Presented) The method of claim 20, wherein the SCF is carbon dioxide.

22. (Original) The method of claim 19, wherein the contacting conditions comprise pressures in a range of from about 1400 to about 4400 psi.
23. (Original) The method of claim 19, wherein said contacting time is in a range of from about 30 seconds to about 30 minutes.
24. (Original) The method of claim 19, wherein the co-solvent comprises at least one C₁-C₆ alcohol.
25. (Original) The method of claim 19, wherein the co-solvent comprises methanol.
26. (Original) The method of claim 19, wherein the co-solvent comprises isopropanol (IPA).
27. (Original) The method of claim 19, wherein the silicon-containing substance is selected from the group consisting of silicon oxide and silicon nitride.
28. (Currently Amended) The method of claim 19, wherein the at least one etchant species further comprises at least one additional bifluoride compound selected from the group consisting of ammonium bifluoride, and tetraalkylammonium difluoride ((R)₄NHF₂), wherein R is selected from the group consisting of hydrogen, [[a]] C₁-C₄ alkyl group, phenyl, and fluorinated C₁-C₄ alkyl.
29. (Cancelled)
30. (Currently Amended) The method of claim 19, comprising said surfactant, wherein the surfactant comprises at least one nonionic or anionic surfactant, or a combination thereof.

31. (Original) The method of claim 30, wherein the nonionic surfactant is selected from the group consisting of fluoroalkyl surfactants, polyethylene glycols, polypropylene glycols, polyethylene ethers, polypropylene glycol ethers, carboxylic acid salts, dodecylbenzenesulfonic acid, dodecylbenzenesulfonic salts, polyacrylate polymers, dinonylphenyl polyoxyethylene, silicone polymers, modified silicone polymers, acetylenic diols, modified acetylenic diols, alkylammonium salts, modified alkylammonium salts, and combinations comprising at least one of the foregoing.

32. (Currently Amended) The method of claim 20 [[19]], comprising said surfactant, wherein the SCF-based composition comprises about 75.0 wt % to about 99.5 wt % SCF, about 0.3 wt % to about 22.5 wt % co-solvent, about 0.01 wt % to about 5.0 wt % etchant species, and about 0.01 wt % to about 5.0 wt % surfactant, based on the total weight of the composition.

33. (Cancelled)

34. (Cancelled)

35. (Cancelled)

36. (Currently Amended) The method of claim 19, wherein the silicon-containing substance is selected from the group consisting of post-etch residue and post-ash residue 31, wherein the SCF-based composition comprises about 75.0 wt % to about 99.5 wt % SCF, about 0.3 wt % to about 22.5 wt % co-solvent, about 0.01 wt % to about 5.0 wt % etchant species, based on the total weight of the composition.

37. (Currently Amended) The method of claim 19, wherein the contacting step comprises an etching cycle including (i) dynamic flow contacting of the SCF-based etching composition with the silicon-containing substance, and/or (ii) static soaking contacting of the SCF-based etching composition with the silicon-containing substance.

38. (Original) The method of claim 37, wherein said etching cycle comprises alternately and repetitively carrying out dynamic flow contacting and static soaking contacting of the silicon-containing substance.

39. (Original) The method of claim 19, further comprising the step of washing the substrate, at a region at which the silicon-containing substance has been removed, with a SCF/methanol/deionized water wash solution in a first washing step, and with a SCF in a second washing step, to remove residual precipitated chemical additives in said first washing step, and to remove residual precipitated chemical additives and/or residual alcohol in said second washing step.

40. (Original) The method of claim 39, wherein the SCF is SCCO_2 .

41. (Previously Presented) The composition of claim 1, further comprising silicon-containing residue material.

42. (Previously Presented) The composition of claim 41, wherein the silicon-containing residue material is selected from the group consisting of silicon oxide and silicon nitride.

43. (Cancelled)

44. (New) A method of manufacturing a semiconductor comprising the method of claim 19 in said manufacturing of said semiconductor.